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COMMITTEE ON PAPERS AND PUBLICATIONS:

J. F. GEISLER,
A. C. HALE,
A. A. BRENEMAN, Editor.

ABSTRACTOR FOR AMERICAN PATENTS:

J. F. GEISLER.

INDEX NUMBER.

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List of Officers and Members of the American Chemical Society for the Year 1891.
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1891.

The Journal of the American Chemical Society appears monthly, except during July and August. It will contain all papers read before the Society, as well as abstracts from American and Foreign Journals, and a list of American Patents relating to Chemical Industries.

The Price of Subscription is $5.00 per year, in advance.

The Meeting Room of the Society is the Law Lecture Room, University Building, Washington Square, New York.

The Regular Monthly Meeting is held on the first Friday of every month, at 8 P. M.

Corresponding Secretary:

A. C. HALE, 551 Putnam Ave., Brooklyn, N. Y.

Treasurer:

F. T. KING, 91 Columbia Heights, Brooklyn, N. Y.

The Library of the Society in the Library Room of the University of the City of New York, is accessible daily, from 10 A. M. to 5 P. M., on Tuesday and Wednesday evenings, and on the evenings of the regular monthly meetings of the Society.

Back numbers of the Journal are sold to Members at $3.00, to others at $5.00, per volume. Apply to the Librarian

C. F. McKENNA, 426 E. 23d St., New York.

The Committee on Papers and Publications respectfully call attention to the resolutions of the Society, requiring that papers be submitted to the Committee before being read.

Authors will be furnished, gratis, with 20 reprints of each article published in the Journal, *if application for the same be made when the article is sent.*

Members are requested to give notice of any change of address, or failure in the delivery of the Journal. All communications relating to the Journal should be addressed to the Editor.

A. A. BRENEMAN, 97 Water St., New York.

REGULAR MEETING, December 4, 1891.

The regular meeting of the Society was held in the Law Lecture Room of the University, at 8 P. M., President Geo. F. Barker in the chair.

The minutes of the November meeting were read, amended and accepted.

It was moved that the business of the Annual Meeting, which would now be in order, be deferred until the general meeting, to be held in New York on Dec. 29th and 30th. Carried.

The following members were then elected :

Guy E. Couch, 44 W. Court St., Cincinnati, O.
J. C. Dittrich, 128 E. 54th St., N. Y.
Walter D. Field, 40 S. Portland Ave., Brooklyn, N. Y.
Wm. J. Karslake, 7 Kay St., Newport, R. I.
J. U. Lloyd, E. Norwood, Ohio.
Jas. H. Hyndman, 98 W. 9th St., Cincinnati, O.
Wm. N. Mumper, Hughes High School, Cincinnati, O.
H. T. Nichols, Avondale, Cincinnati, O.
Prof. T. H. Norton, Univ. of Cincinnati, Cincinnati, O.
Prof. L. M. Norton, Mass. Inst. of Technology, Boston.
W. Simonson, 9th and Race Sts., Cincinnati, O.
Dr. Sigmond Waldbott, 150 E. 5th St., Cincinnati, O.
E. C. Wallace, 62 Loth St., Cincinnati, O.
B. D. Westenfelder, Am. Oak Leather Co., Cincinnati, O.
Prof. Chauncy R. Stuntz, Woodward High School, Cincinnati, O.
Earnest Twitchell, 559 W. 7th St., Cincinnati, O.

The following were proposed for membership :

Frank H. Andrews, Providence, R. I.
Lyman C. Newell, Providence, R. I.
Clarence E. Wilson, Providence, R. I.

The following papers were read :

I.—Experimental Chemistry in the 18th Century. Extracts from Unpublished Letters of Joseph Priestley (with exhibition of engraved portraits of contemporaries), by Dr. H. Carrington Bolton.

II.—Apparatus for the Delineation of Curved Surfaces, in illustration of the Properties of Gases, etc., by Dr. Morris Loeb.

III.—A New Burette Holder, by Prof. A. A. Breneman.*

The resignation of W. T. Lees was read and accepted.

The meeting was then adjourned to the 29th day of December, 1891.

DURAND WOODMAN,
Recording Secretary.

EXPERIMENTAL CHEMISTRY IN THE EIGHTEENTH CENTURY.

BY DR. H. CARRINGTON BOLTON.

The above title was the subject of an evening lecture before the Society, which, from the nature of it, is unsuited for reproduction here.

A number of letters were read, and portraits of men of science and others, contemporaries of Priestly, were shown. Much of this material has since been published by the author in the form of a book.

*Will appear in January number.

APPARATUS FOR THE DELINEATION OF CURVED SURFACES, IN ILLUSTRATION OF THE PROPERTIES OF GASES, ETC.

By Morris Loeb, Ph.D.

In attempting the graphic representation of the relations between the volume, temperature and pressure of gases, or of other problems involving three variables, one is met by the difficulty of properly constructing the surfaces in question. Drawing isothermals, etc., as projected upon a single plane, gives a very imperfect idea of the actual proportions. For many years this method has been occasionally supplanted by the actual construction, in papier maché or plaster, of models bounded on one side by the surface in question, relief maps in other words. This plan suffers from several disadvantages. Aside from the notion of solid volume which is involuntary entertained in beholding such a model, some of the surfaces are too complex to be well shown in this manner. Furthermore, the models are rather hard to make, expensive and occupy a good deal of room.

I have obviated most of these difficulties by obtaining a set of glass plates, about 11 cm. square and 7 mm. thick, ruled in squares 7 mm. wide. Placed one on top of the other, these form a block whose perpendicular edge may be taken for the third axis in a system of rectangular co-ordinates. Having drawn upon a sheet of paper the curves representing the relation between volume and pressure at successively 0°, 10°, 20°, 30°, etc., of temperature, I can trace them, with suitable grease-chalks, upon the successive glass plates. When these are superposed, the curves exhibit the proper relations in space and afford a very fair idea of the nature of the surface of which they are elements, without arousing any sensation of an included volume. Since the lines can always be erased and replaced by others, a set of twenty plates suffices for all purposes, and the surfaces can be produced at a moment's notice if the necessary sketches on paper are preserved. Besides

being useful for illustrating lectures in molecular physics, the plates can also be employed to advantage in the construction of crystallographic, geological and other models.

Where the parallax, inevitable for glass plates, becomes annoying, it is possible to substitute wide-meshed cotton netting, stretched upon square frames of uniform thickness. The curves can be embroidered upon the net, as it were, with pieces of colored thread; although it is not quite so easy to make the lines conform to the drawing, the general effect remains the same.

FOURTH GENERAL MEETING.

Dec. 29th and 30th, 1891.

FIRST DAY'S SESSION.

The meeting was called to order at 11 A. M. in the chapel of the University of the City of New York, the president, Prof. Geo. F. Barker, in the chair.

Chancellor Henry M. McCracken, of the University of the City of New York, having been introduced by Prof. McMurtrie, the chairman of the Committee of Arrangements, welcomed the society to the University and to the city.

President Barker replied briefly, referring to the contributions which the University had made to science through the work of Morse and the Drapers.

The Secretary announced the various places of interest to be visited after the close of the session; the first being the Columbia College School of Mines (upon the invitation of Prof. Chandler), then the Ehret Brewery, the Works of the Brin Oxygen Process Co., etc.

The following gentlemen were nominated for membership:

E. H. Adams, of N. Y. Tartar Co., 9th St. and Gowanus Canal, Brooklyn, N. Y.

Wm. N. Berkeley, University of Va., Va.

Prof. J. S. Cassidy, Covington, Ky.
Geo. C. Davis, B. S., Pottsville, Pa.
Prof. Chas. T. P. Fennel, Cincinnati Coll. of Phar., Cinn., O.
Chas. R. Findley, Abingdon, Va.
Paul C. Freer, Ann Harbor, Mich.
John G. Hall, Natrona, Pa.
D. W. Hoyt, A. M., High School, Providence, R. I.
Chas. A. Harper, Cinn. Univ., Cincinnati, O.
Otis C. Johnson, Ann Harbor, Mich.
Dr. Jos. M. Locke, 58 W. 3d St., Cincinnati, O.
Horatio Loomis, Burlington, Vt.
Oscar Lowman, Ph. D.
W. J. Matheson, 178 Front St., New York.
Chas. G. Merrell, B. S., Mass. Inst. Tech., Boston.
Dr. S. B. Newberry, Cornell Univ., Ithaca, N. Y.
David J. Ogilvy.
Pedro J. Sosa, Panama, Columbia, S. A.
Prof. G. G. Pond, State College, Pa.
Prof. Victor C. Vaughan, Ann Arbor, Mich.
Fred. J. Walling, Smith and Bergen Sts., Brooklyn, N. Y.
Prof. A. V. E. Young, Northwestern Univ., Chicago, Ill.

It was moved that the polls for the annual election be closed a half hour after the lose of the day's session instead of at five o'clock as announced on the programme. Carried.

The chair called for open nominations if members desired to add to those offered by the Nominating Committee. None were made.

The names of the Committee on Revision of the Constitution were read and on motion a meeting of this committee was called at two o'clock.

Letters were read from Dr. C. A. Goessmann, Dr. J. W. Mallet, Dr. A. B. Prescott, Dr. T. Sterry Hunt, and others regretting their inability to be present.

The following papers were read:

I.—The Post Mortem Diffusion of Arsenic, a result of Embalming, by C. A. Doremus.

II.—On the Composition of Baryto-celestite, by C. W. Volney.

On motion the meeting was then adjourned until ten o'clock Wednesday morning, Dec. 30.

DURAND WOODMAN,
Recording Secretary.

SECOND DAY'S SESSION.

Wednesday, Dec. 30, 1891.

The meeting was called to order at 10:45 A. M. in the chapel of the University, President G. F. Barker in the chair.

It was announced that a luncheon would be served at one o'clock, through the courtesy of the University authorities.

An invitation was extended by Professors R. Ogden and Chas. A. Doremus to visit the College of the City of New York, and by Professor Leeds to visit the Stevens Institute.

A telegram from Prof. S. W. Johnson was read, regretting his inability to be present.

An invitation was received from Dr. Torrey to visit the U. S. Assay Office.

A letter of regret was read from Prof. Springer, of Cincinnati.

The following papers were read :

I.—On the Advance in Fractional Analysis of Silicates, by F. W. Clarke.

II.—An Alchemical Chart by W. P. Mason.

III.—On Disulphotetraphenylene, by C. E. Lineburger. Read by the secretary in absence of the author.

IV.—On the properties of matter considered as Periodic Functions of the Atomic Weights, by A. R. Leeds.*

Prof. Breneman suggested that an informal discussion be held in order to test the sense of the meeting in regard to an International Congress of Chemists at Chicago in 1893.

*A preliminary notice. The paper is reserved by the author for completion. Will appear in a later number.

The Chair: "A Congressional Commission has, I understand, been appointed and should be coöperated with. Invitations will be issued in the name of the Columbian Exhibition only."

Prof. A. V. E. Young, of Chicago Northwestern University, a member of the Chicago Committee of Chemists already formed to consider the subject, stated that a World's Congress of scientific men had been provided for covering a wide range of scientific interest. Different interests are to have stated times devoted to them during the Columbian Exhibition. The question now is how best to obtain the coöperation of existing organizations, and further, how best to attract people to this congress. The Congresses on Science and Philosophy are set down for the last two weeks in July, 1893.

A discussion then took place as to what action should be taken by the Society.

The polls were closed at twelve o'clock and Prof. J. H. Appleton and Prof. W. L. Dudley were appointed tellers to ascertain the result of the election.

Prof. McMurtrie offered the following resolution :

Resolved, That a committee of five be appointed by the chair to arrange for a general meeting of this Society, to be held in Chicago in the Summer of 1893, and to offer the coöperation of the Society to the authorities of the Columbian Exposition in arranging for an International Congress of Chemists and that this committee have power to add to its number. Carried.

At 12:50 an adjournment was taken for luncheon.

At 1:30 the meeting was again called to order.

The chair appointed Messrs. McMurtrie, Chandler, Prescott, Wiley and Munroe, a Committee on General Meeting at Chicago in 1893.

Prof. Caldwell, chairman of the Committee on Revision of the Constitution and By-laws, reported that a copy of the Constitution, Charter and By-laws would be mailed with each copy of the next number of the JOURNAL, and asked an expression of opinion from members as to changes desired.

A letter was read from Prof. Springer suggesting that the Society consider the methods of milk analysis and recommend the adoption of a uniform method.

Prof. McMurtrie moved that the Society endorse the methods of milk analysis adopted by the Association of Official Agricultural Chemists, and urge their adoption by the chemists of the country.

Prof. Loeb moved to lay this motion on the table. Seconded.

Prof. Caldwell thought it unwise to take up the matter of milk analysis in the condition in which it now stands at the hands of the Association of Official Agricultural Chemists. He was able to say, as one of them, that not a great deal of work had been done in this direction.

Prof. Loeb entered a protest against giving any opinion, either by vote or otherwise, favorable to anything about which the majority of the members knew nothing in particular, and objected to the Society, as a body, giving its endorsement to anything.

Dr. Chandler: I agree with Dr. Loeb and think we should end in disaster if we begin to endorse any special methods of analysis.

Prof. Caldwell then offered the following resolution as a substitute for the previous resolutions:

Resolved, That it is inexpedient for this Society to take action looking towards the official endorsement of any methods of technical analysis. Seconded and carried.

Prof. Loeb moved that all authors sending papers to the Society be requested to send specimens of all new substances descriptive of such papers to the Society. Carried.

The tellers announced the result of the elections.*

President.

G. C. CALDWELL.

Vice-Presidents.

A. A. BRENEMAN, A. R. LEEDS, E. WALLER.
EDWARD HART, C. B. DUDLEY, E. S. WOOD.

*A second ballot was taken for the election of President, Treasurer, one member of the Board of Directors, and one member of the Advisory Council, with the following results:

President, G. C. Caldwell.

Treasurer, C. F. McKenna.

Member of board of directors, Wm. McMurtrie.

Member of advisory council, Alfred Springer.

Corresponding Secretary, A. C. HALE.
Recording Secretary, DURAND WOODMAN.
Treasurer, C. F. MCKENNA.
Librarian, C. E. MUNSELL.

Curators.

W. H. KENT, F. VANDERPOOL, A. H. SABIN.

Committee on Papers and Publications.

A. C. HALE, A. A. BRENEMAN, J. F. GEISLER.

Committee on Nominations.

A. H. SABIN, C. A. DOREMUS,
A. P. HALLOCK, W. H. KENT,
LUCIUS PITKIN.

Board of Directors.

G. C. CALDWELL, DURAND WOODMAN,
A. A. BRENEMAN, A. P. HALLOCK,
E. WALLER, J. H. STEBBINS, JR.,
A. R. LEEDS, L. H. FRIEDBURG,
A. C. HALE, WILLIAM MCMURTRIE,
R. W. HALL, J. F. GEISLER,
C. F. MCKENNA.

Advisory Council.

F. W. CLARKE, H. W. WILEY,
ALFRED SPRINGER, G. F. BARKER.

It was moved that the thanks of the Society be given to the local committee for the efficient provision that had been made by them for the convenience and entertainment of the members during attendance at the meeting.

A vote of thanks was also offered to the Chancellor and the authorities of the University for all the courtesies received by the Society at their hands.

It was further moved that the thanks of the Society be tendered to the Ehret Brewing Co., the Mutual Gas Light Co., the Equitable Gas Light Co., the Brin Oxygen Co., the De La Vergne Refrigerating Co., the Chemical Manufacturers of New York and to all others from whom the Society has received courtesies. Seconded and carried.

The retiring president, Prof. Barker, expressed his sense of the pleasing relations that had marked his term of office and congratulated the Society upon the election of his successor.

A motion to adjourn was then made and seconded, and the fourth general meeting was adjourned.

DURAND WOODMAN,
Recording Secretary.

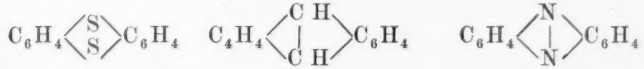
ON DISULPHOTETRAPHENYLENE.

BY C. E. LINEBURGER.

Since the work of Stenhouse[1] and Graebe[2] on Disulphodiphenelyne and its derivatives, no one, so far as I know, has taken up the investigation of the subject, except Friedel and Crafts, who have effected the synthesis of the compound by means of the reaction of the sulphur chloride on benzene in the presence of aluminium chloride. These chemists have not studied the substance further. Still the constitution of the compound seems to be such as to lend itself easily to synthesis, and now that it can be so easily prepared by means of the Friedel-Crafts reaction, nothing prevents its further study. I have therefore tried to carry out some of the reactions of which disulphodiphenylene seemed capable.

(1) Liebig's Ann., **140,** *284* and **156,** *332*.
(2) Liebig's Ann., **174,** *177;* **179,** *178*, and **180,** *234*.

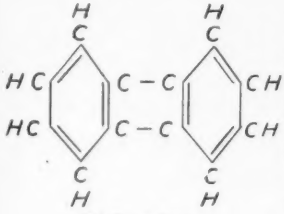
From one point of view, the constitution of disulphodiphenyline much resembles that of anthracene and phenazine:



Disulphodiphenylene. Anthracene. Phenazine.

It was thought possible to pass, by means of suitable reactions, from one compound to another. I first tried to replace the sulphur atoms in disulphodiphenylene, by the imide group NH. I heated a pure disulphodiphenylene with alcohol saturated with ammonia, in sealed tubes, for more than twenty-four hours at 280°. If the temperature ran higher than 280°, the tubes invariably burst. No reaction, however, took place below 280°, the disulphodiphenylene forming long, finely formed crystals on cooling. The fact that above 280° the tubes burst, no matter whether filled with large or small quantities of substance, indicates that a reaction must have taken place with great violence. As it was impossible to control this reaction, I let dry ammonia act upon boiling disulphodiphenylene. I passed a rapid stream of ammonia into a quantity of disulphodiphenylene which was kept boiling vigorously for several hours. However, not a trace of sulphuretted hydrogen could be found in the ammonia that passed off. The disulphodiphenylene was, indeed, much blackened and gave off a foul odor, but I have found that by prolonged boiling this change always takes place. Disulphodiphenylene decomposes slowly on being distilled; a little black resin always remains in the retort. At any rate, the reaction, if reaction there was, between ammonia and disulphodiphenylene did not take place in the way sought for.

Attempts were then made to form diphenylene by the removal of the sulphur and the union of the carbon atoms. As disulphodiphenylene distils unchanged over freshly reduced copper, it was necessary, in order to bring about a reaction, to pass the vapor of the compound over copper heated to intense redness. Even then a portion of the substance remained unchanged. The stability of the molecules is truly remarkable.



Diphenylene.

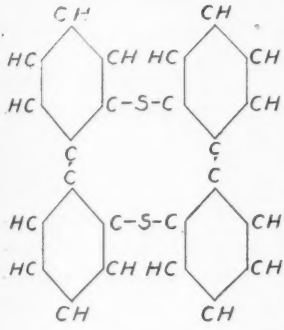
The details of the experiment are as follows: About 10 grms of disulphodiphenylene are put in the bottom of a hard glass tube about twenty mm. in diameter and fifty cm. long, and above this is a plug of asbestos. The rest of the tube is filled in with freshly reduced copper coarsely powdered. The open end of the tube is luted into a flask of about the capacity of a litre in the side of which a small hole is made by means of the blow pipe, so that the gases and uncondensed vapors may escape freely. The tube is now laid in a small combustion furnace, placed in a slanting position. The copper is first heated as hot as possible, and then the disulphodiphenylene *slowly* distilled over it. Quite a decomposition takes place with evolution of ill-smelling fumes. Care must be taken that the orifice in the flask does not become stopped up as the internal pressure will force the lute or blow open the hot tube. A dark colored distillate collects in the flask, where it solidifies on cooling. When all the substance has been distilled over the copper, the flask is disconnected and its contents treated with strong alcohol. After the insoluble resin is filtered off, the filtrate is set aside to crystalize. In a few days a crystalline crust separates out along the sides of the dish. This seems to contain alcohol of crystallization, for, on heating the air-dried substance alcohol is given off. After melting the crystalline crusts to divide off the alcohol, therefore, I dissolved the melt in benzene, in which it is very soluble. On evaporation, irregularly shaped masses of white crystals separated out which did not melt at all well. Evidently we have to do here with a mixture. In experimenting, I found that by sublimation I was able to obtain the greater part of the compound in long white needles. The sublimation takes place at quite a low temperature and the crystals obtained melt very well at 101°. As sublimation proved a much better means of purification than crystallization, I made use of it throughout.

An analysis of the sublimate carried out in a bayonet tube with a mixture of copper oxide and lead chromate gave the following results:

	I.	II.	Calc. for $C_{12}H_8S$.
C	77.88	77.97	78.25
H	4.35	4.45	4.35

The substance therefore contains sulphur and is not diphenylene.

One would infer from the analysis that it was simply diphenylene sulphide formed by the removal of an atom of sulphur from the disulphodiphenylene and consequent union of the two bonds thus set free. But its properties differ greatly from those of diphenylene sulphide. Diphenylene sulphide melts at 94° (Stenhouse), 97° (Graebe), and boils at 332°–333°. The substance in question melts at 101° and boils at 414°, under a pressure of 753 mm. of mercury. The former crystalizes in long needles from strong alcohol; the latter separates out as an indefinite crystalline crust from its alcoholic solution. Also, in their behavior towards oxidizing agents, the two substances differ markedly. By the action of potassium dichromate and dilute sulphuric acid on diphenylene sulphide, diphenylene sulphone $C_{12}H_8SO_2$, is formed. The new compound is hardly attacked by the oxidizing mixture, even though heated with it for several hours. These facts establish definitely that the substance obtained, although possessing the same percentage composition, is not diphenylene sulphide. From facts of which I will speak further on I am led to give the substance a formula isomeric with that of diphenylene sulphide having this constitution. I will call the compound then, from its mode of formation, disulphotetraphenylene.



Disulphotetraphenylene possesses an uncommon stability. All the methods used for estimating the sulphur were inadequate. This fact is in a certain way so noteworthy that I will describe cursorily the experiments carried out for the purpose of determining the sulphur. .1372 grms. of the substance were heated with fuming nitric acid in a sealed tube for six days at 300–350°. The tube was of thick glass, such as used by

Berthelot in his experiments on reduction by means of hydriodic acid. Disulphotetraphenylene dissolves easily in cold fuming nitric acid, an oxidation product or a nitro derivative being probably formed. This is so stable, however, that it was not at all destroyed on heating. On opening the tube little pressure was manifest, and on diluting the contents with water, a white organic precipitate was thrown down.

.3024 grms. were placed in a hard glass tube containing potassium nitrate and sodium carbonate, the whole being arranged as recommended by Volhard[3]. But even though the vapor of the substance had to pass through a column nearly 20 cm. long of the fused alkalies kept at an intense heat, the combustion was not perfect, and vapors containing sulphur escaped from the tube.

A combustion tube about a yard long was filled about two-thirds full of dry sodium carbonate; then came a porcelain boat containing the compound, and after the boat a spiral of platinum wire., While a rapid stream of oxygen was passed through the tube, and while the platinum spiral was kept at a high heat, the substance was *slowly* distilled over upon the sodium carbonate. But even though the salt was heated intensely some of the substance passed over unchanged and condensed in the cooler portion of the tube in white needles melting at 101°. However, although I was unable to make a determination of the sulphur in the compound there is no doubt but that it has the composition given above. Being formed in a reducing medium, it would be impossible for oxygen to be present.

Another fact that renders the above constitution very probable is that the two sulphur atoms in disulphodiphenylene are not attached to the molecule with the same force. One may be removed quite easily and by a rather unexpected agent. Disulphodiphenylene dissolves in fuming nitric acid with evolution of reddish fumes even at 0°. If water be added to the solution, a white precipitate is thrown down, which is nothing but diphenylene sulphone. If barium chloride be added to the filtrate from this precipitate, barium sulphate is formed, that is, the filtrate contains

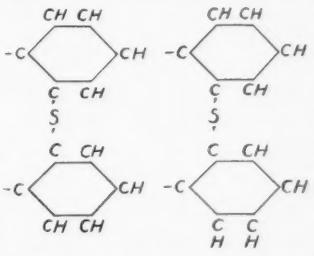
[3] Liebig's Annalen, 190, 1.

sulphuric acid. The reaction may be interpreted in two ways:

First.—The nitric acid removes at once an atom of sulphur from the disulphodiphenylene, and oxidizes it to sulphuric acid, while the bonds of carbon left free unite with each other and the second atom of sulphur is oxidized to the sulphone group.

Second.—The nitric acid oxidizes immediately the disulphodiphenylene to diphenylene disulphone, which, by further action of the acid, is decomposed into diphenylene sulphone and sulphur dioxide, the latter product being then oxidized to sulphuric acid.

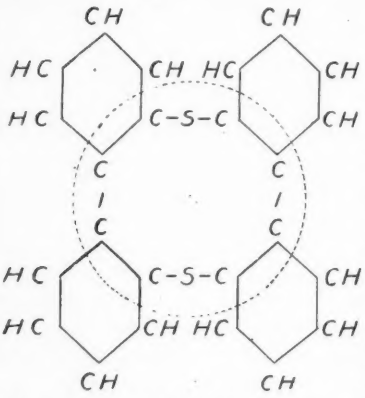
These two interpretations really amount to the same thing. In both cases it is a removal of sulphur from the molecule with union of the bonds thus set free and the oxidation of the remaining sulphur atom. It is rather strange that such a reaction should be brought about by such a reagent as fuming nitric acid; but, at any rate, this explains well the formation of disulphotetraphenylene. The heated copper is able to remove the loosely bound sulphur atom, but the other atom succeeds in escaping its action. The residues of molecules thus formed seem to prefer to unite two by two, giving disulphotetraphenylene.



The question arises why, in the reaction of nitric acid on disulphodiphenylene, disulphotetraphenylene or an oxidation product of the same is not formed. The question is a difficult one to answer. The conditions of the two experiments differ widely. In the one case, we have to do with a strong oxidizing agent at a low temperature, in the other with a powerful reducing agent at a high temperature. This may be the reason that the product of the two reactions are so different. It is, indeed, a little strained to assume that union between free carbon bonds takes place in adjacent molecules rather than in the same molecule. But the fact is that in the reaction of heated copper on disulphodiphenylene, but little, if any, diphenylene sulphide is formed while a comparatively large amount of a

substance with the same percentage composition, but widely different properties, is formed.

Disulphotetraphenylene possesses a ring-like structure, the ring consisting of eight carbon and two sulphur atoms.



A noteworthy fact about this ring is its remarkable stability towards heat. I have not yet obtained a sufficient quantity to make a thorough study of the action of the halogens and oxidizing and reducing agents on it. It is not by any means the only product obtained in the reaction. A quite large quantity of a resin is also obtained. Disulphotetraphenylene is, however, the only compound that I have been able to obtain in a state of purity. I am engaged in preparing a larger amount of the compound in order to carry out a thorough investigation, the results of which I hope to be able to communicate in the near future.

This work was done in the laboratory of Professor Friedel in Paris.

THE FRACTIONAL ANALYSIS OF SILICATES.

By F. W. Clarke.

In the course of some investigations upon the constitution of the natural silicates, it was found that in most cases the empirical formulæ were capable of interpretation in various distinct ways, leading to different structural expressions of equal probability. In some instances there was available evidence by means of which it was possible to choose between alternative formulæ; the final decision resting sometimes upon the association of minerals in nature, and sometimes upon the alterations which they undergo. Such data, however, are not always readily available, and even at their best they only establish presumptions in place of giving satisfactory proof. It became necessary, therefore, to seek for new data of an experimental kind, which should be analogous to the data used by the organic chemist in fixing the constitution of carbon compounds, and by their means to put the problem upon a more satisfactory footing.

Two difficulties were evident from the start. First, the impossibility, in the present state of our knowledge, of measuring the molecular weights of the silicates; and secondly, the lack of plasticity in the material under investigation. The first difficulty is still unsurmountable; but the second is less formidable than it appeared at first, and the experiments presently to be described open up a feasible line of attack upon the outworks of the problem. The results are appearing in detail in a series of mineralogical papers by E. A. Schneider and myself; and only an outline of the chemical methods need be given in this communication. So far, the minerals studied belong mainly to the mica and chlorite groups, with a few other magnesian silicates like talc, serpentine and olivine, as accessories; and it remains to be ascertained whether the methods applicable to these compounds will fit other cases equally well. Theoretically, the outlook is favorable, but difficulties may exist which cannot be foreseen.

Of the minerals heretofore examined, all but one, olivine, contain water. This may represent water of crystallization, acid hydrogen, or hydroxyl in union with basic atoms, and the first problem is to discriminate between these several possibilities. To begin with, the relative stability of the water in each molecule gives a clue to its character; water of crystallization being easily expelled at comparatively low temperatures, and water of constitution being more tenaciously retained. In each case, therefore, the temperature of dehydration was roughly ascertained; every mineral being heated to constant weight first at 100°, then at 250°–300°, and finally at a full red heat. Whenever ferrous iron was present, the total water was also determined directly and so the errors due to possible oxidation during ignition were avoided. Studied in this way the vermiculite micas kerrite, jefferisite, and protovermiculite gave exceedingly suggestive results, each mineral corresponding to an ordinary mica, plus three molecules of water of crystallization, and with the alkaline metals of the original mineral equivalently replaced by hydrogen. Furthermore, the crystalline water fell sharply into two parts; two molecules being expelled at 100°, and the third being given off below 250°. Thus a mica having the composition $Al(SiO_4)_3Mg_3KH_2$ would yield by hydrous alteration a vermiculite represented by the formula $Al(SiO_4)_3Mg_3H_3+3H_2O$, to which latter compound kerrite approximately corresponds. In the true micas and chlorites the water does not seem to break up into separate fractions upon mere heating, and, being stable up to or near redness, is to be regarded as constitutional.

Up to this point the work done presents no particular novelty, and involves no new modes of procedure. The fractional determinations of water, however, have a direct bearing upon subsequent experiments, and clear the ground for work of a more troublesome kind. Having evidence before us regarding the amount of hydroxyl in a given silicate molecule, the next problem is to determine its distribution and character. It may be united with silicon, representing unreplaced hydrogen of the original silicic acid, it may be combined with magnesium in a univalent group —Mg—OH, or it may be linked with aluminum as =Al—OH or

$-Al=(OH)_2$. In its broadest aspect, the problem is still far from complete solution, but at one point it has been attacked with some success, as follows:

All of the silicates above mentioned as studied by us, except talc, are easily decomposable by aqueous hydrochloric acid. By dry hydrochloric acid gas, however, they are differently affected, and the differences seem to be due to the character of the hydroxyl. Each silicate in turn was weighed out in a platinum boat, and heated to constant weight at a temperature of about 400° in a stream of the thoroughly dried gas. The temperature, it must be noted, is one at which the water of constitution was still retained by the minerals. Olivine, which *contains no hydroxyl*, was practically unattacked, although the aqueous acid decomposes it with great ease. Talc, the true micas, and the vermiculites, were not acted upon, or at most very trivially. Serpentine and the chlorides, however, were strongly affected; and from them, after the reaction, water extracted considerable amounts of magnesium chloride, in which the magnesia was estimated. In serpentine and ripidolite about one-third of the magnesia was thus removable; or, in other words, the magnesia was separated into two fractions which presumably were differently combined. In these minerals the group —Mg—OH is almost necessarily assumed in any attempt to interpret their structure; and the amount of magnesia taken out as chloride was roughly proportioned to the quantity required by the simplest theory. That is, it seems probable that —Mg—OH in a silicate is converted by dry hydrochloric acid into a chlorhydrin group, —MgCl, the latter, by subsequent action of the gas being split off altogether as chloride, $MgCl_2$. This is the simplest explanation of the phenomena; although the nature of the reaction is by no means proved, and a good deal of investigation into it is still necessary. At all events, as regards the magnesian silicates of the groups studied, the new reaction appears to be a legitimate test for —Mg—OH, even though it may not be strictly quantitative. When action takes place, the group is almost certainly present; when there is little or no action, its absence may fairly be assumed.

In the case of talc, $Mg_3H_2Si_4O_{12}$, the foregoing principle finds ready application. For this mineral two constitutional formulæ

have been proposed ; one, $Mg_3H_2(SiO_3)_4$, regards it as an acid metasilicate; the other, $Mg\begin{cases}Si_2O_5—MgOH\\Si_2O_5—MgOH\end{cases}$ represents it as a basic salt of the acid $H_2Si_2O_5$. Now talc is practically unattacked by hydrochloric acid either wet or dry, and so a presumption is established in favor of the metasilicate formula. The group —Mg—OH is apparently not present. This view, fortunately, is maintained by other evidence, which also serves to illustrate another principle in fractional analysis.

When talc is sharply and quickly ignited, so as to produce complete dehydration, silica is set free. That silica may then be dissolved out by boiling with an aqueous solution of sodium carbonate, and estimated. One-fourth of the total silica of the mineral was thus liberated, its quantitative determination varying only 0.21 per cent. from the exact amount required. This decomposition represents a splitting up of talc in accordance with the following equation :

$$Mg_3H_2Si_4O_{12}=3\,MgSiO_3+SiO_2+H_2O,$$

which is reconcilable only with the metasilicate formula. If the pyrosilicate formula were correct, the expulsion of water would be indicated thus :

$$Mg\begin{cases}Si_2O_5—MgOH\\Si_2O_5—MgOH\end{cases}=Mg\begin{cases}Si_2O_5—Mg\\Si_2O_5—Mg\end{cases}O+H_2O,$$

and it is not easy to see how silica could be split off. In short, the separation of the silica into two fractions, and the evidence furnished by the stability of the talc towards acids, prove that the hydrogen of the mineral is acid hydrogen, and establish the constitution of the species. Of all the possible formulæ for talc, the metasilicate formula alone satisfies the experimental conditions.

It has already been stated that the silicates under discussion, with the exception of talc, are readily decomposable by aqueous hydrochloric acid. Upon ignition, however, most of them split up into soluble and insoluble portions, which can be separately investigated. Serpentine, for example, splits up into soluble olivine and insoluble enstatite ; water, of course, being eliminated. This particular case of decomposition by heat has

long been known; but among the chlorites and the clintonite micas are found some new applications of the principle. Four examples, closely related, may be cited here, namely, three chlorites of similar type, and xanthophyllite, variety walnewite, from Siberia.

The method of investigation was as follows: Each mineral, of which a sample had been previously analyzed, was strongly ignited in powder over a blast. The operation was performed in a covered platinum crucible, and the ignition lasted for several hours. The material was next digested with strong hydrochloric acid, the mixture was evaporated to dryness, the residue treated with weak acid, and finally filtered off. There remained in the filter, of course, the insoluble portions of the minerals, plus the silica which had been liberated from the soluble parts. This silica was then removed by boiling with sodium carbonate solution, and the undissolved remainder was washed, weighed and separately analyzed. In each of the four cases it proved to have the composition of spinel, $MgAl_2O_4$, and in quantity it bore a definite relation to the formulæ of the original minerals. The latter were as follows, with their empirical formulæ subjoined:

A. Ripidolite (clinochlore), from West Chester, Pa.
B. Clinochlore, from Slatoust, Urals.
C. Leuchtenbergite, from Slatoust, Urals.
D. Walnewite, from near Slatoust.

A. $Al_{38}Mg_{86}H_{140}(SiO_4)_{50}O_{113}$.
B. $Al_{38}Mg_{87}H_{143}(SiO_4)_{52}O_{113}$.
C. $Al_{42}Mg_{86}H_{143}(SiO_4)_{50}O_{121}$.
D. $Al_{86}Ca_{24}Mg_{52}H_{50}(SiO_4)_{28}O_{174}$.

Upson dehydration these become:

A. $Al_{38}Mg_{86}(SiO_4)_{50}O_{43}$.
B. $Al_{38}Mg_{87}(SiO_4)_{52}O_{42}$.
C. $Al_{42}Mg_{86}(SiO_4)_{50}O_{49}$.
D. $Al_{86}Mg_{52}Ca_{24}(SiO_4)_{28}O_{149}$.

Here we have, throughout, an excess of oxygen over the group SiO_4; and to that excess the amount of spinel formed by ignition is almost quantitatively proportional.

That a decomposition of this sort furnishes strong evidence relative to the constitution of the minerals in question, is clear without argument. Since, however, it is the purpose of the present paper merely to give a brief indication of methods in fractional analysis, an elaborate theoretical discussion would be out of place in it. The data, in all their relations, are being fully considered elsewhere*, and only a short notice of their bearing is needed here. In the chlorites the group —Mg—OH is certainly present; and the three examples here given all reduce to the general formula $Mg_2 (SiO_4)_2 R'_4$, in which R′ is partly H, partly MgOH, and partly AlO_2H_2. The juxtaposition of the two latter groups serves to explain the formation of spinel upon ignition; while the soluble portions of the decomposed material appear to be mixtures of olivine and magnesian garnet, minerals which are common sources of chlorites in nature. Quite recently, Tschermak has sought to show that these particular chlorites are mixtures of amesite and serpentine. But serpentine, when ignited, yields insoluble enstatite, while the three chlorites studied give only spinel in the residue undissolved by hydrochloric acid. The inference is that the chlorites contain no serpentine molecules, and Tschemrak's view becomes untenable.

In the case of the walnewite, the spinel reaction has peculiar interest. In that mineral, the most basic known member of the clintonite group, there is good reason for assuming the existence of a univalent group—Al$\begin{matrix}O\\<\\O\end{matrix}$>Mg, or—Mg—O—Al=O, each form of expression having its own theoretical advantages. The walnewite itself appears to be a mixture of isomorphous molecules, among which the compound $(AlO_2Mg)_4SiO_4$ is predominant. Such a compound might easily split up into olivine and spinel, $Mg_2SiO_4 + 2MgAl_2O_4$, and the quantity of spinel actually formed when walnewite is decomposed by heat, is almost exactly the amount required by theory. Two of the groups $—AlO_2Mg$, coalesce, with removal of one atom of magnesium, to form spinel, while the

*Am. Journ. Sci., Oct., Nov., Dec., 1890; Sept. 1891; March, April, 1892.

magnesium thus eliminated goes into the soluble olivine. The fact that the clintonite micas are almost invariably associated with spinel in nature, and frequently also with members of the olivine group, is very suggestive in this connection. The evidence of natural association and the evidence from the laboratory converge to one set of conclusions.

In the light of the foregoing statements the term "fractional analysis" practically defines itself. It is really an attempt at rational, as distinguished from empirical analysis; and it brings into the mineralogical laboratory the methods of the organic chemist. As yet, little more than a beginning has been made, but the field is promising and should yield a rich crop of valuable data. The researches are still in progress; and the results will be made public as rapidly as may be possible.

POST-MORTEM DIFFUSION OF ARSENIC, THE RESULT OF EMBALMING.

CHARLES A. DOREMUS, M. D., PH.D.

James H. B———, a painter by trade, died on the morning of September 15th, 1891, after an illness, diagnosed by the attending physician as remittent fever.

Two hours after death the undertaker thrust an injecting needle into the abdomen of the deceased and injected a quantity of embalming fluid. The needle passed also above the diaphragm and the fluid was found on the autopsy to partly fill the thorax as well as the abdomen. This fluid contained about 100 grains arsenious oxide and ten grains zinc sulphate to the fluid ounce.

Coroner John Mathews took charge of the case because of rumors of foul play and ordered an autopsy. This was performed September 16th, by Dr. G. A. Lyons, twenty-four hours after the embalming. Parts of the viscera were removed. There was extensive peritonitis and there were pathological conditions that confirmed the

symptoms evidenced before death. The coroner judged, however, and rightly, that it would be wise to remove all doubt concerning alleged arsenical poisoning and the brain and other organs were brought me for toxicological analysis.

One-half the brain, 710 grms., was treated by the potassium chlorate and hydrochloric acid method for the detection of metallic poisons, and two milligrams of arsenious sulphide, equivalent to 1.6 milligrams arsenious oxide, extracted. The presence of arsenic was confirmed by other tests, especially that of Marsh.

The examination was continued and lead, copper and a minute quantity of zinc were also identified by their appropriate tests. The separation of these metals from the arsenic and from each other was quite difficult, and the detection of the zinc was particularly laborious, since the normal earthy phosphates and iron had to be separated, and, in this case, the lead showed a most harassing tendency to pass into analytical groups where it did not belong.

Had arsenic alone been found, a doubt would have at once arisen as to whether it was due to ante-mortem administration or post-mortem diffusion, and zinc was searched for with great care to clear up that point. The non-administration of arsenic in medicine, the very fluid condition of the blood, the injection of the embalming liquid so soon after death, the now well known fact that poisons such as these do diffuse through the tissues, even to parts remote from the point of injection,* and the absence of arsenic all lead to the conclusion that death was due to disease rather than poisoning.

While no other organs or parts of the body were analyzed it might be possible that arsenic had been absorbed during life along with lead and copper. It is well known, however, that arsenic is rapidly eliminated from the system while lead and copper are not. The man had an illness lasting from ten days to two weeks, during which time he did not work at his trade; any arsenic he might have obtained from such sources would, in all likelihood, have passed from him. The testimony of the attending physician and the history of the findings of the post-mortem agreed very closely,

* R. O. Doremus, 1859.

and the jury found a verdict of death due to peritonitis. The jury also took occasion to censure the zeal of undertakers in their over prompt use of embalming agents.

The discussions which arose some years since over post-mortem imbibition of arsenic, have been set at rest in great measure by the experiments made on the diffusion of this substance through the tissues of dead animals and the human cadaver. The brain has been selected as that organ least likely to absorb the poison after death, and therefore to yield the surest evidence of poisoning. The experiments of R. A. Witthaus, published in the Researches of Loomis' Laboratory, 1890, p. 38–52, show that arsenic diffuses to the brain when injected in such manner as to prevent its getting there by direct channels.

As previous experiments and papers on this topic are summarized in the article just quoted only a subsequent case is here cited.

Dr. F. A. Durell, Medical Examiner of Somerville, Mass., relates in the *Medical and Surgical Journal,* of Boston, 1890, Vol. CXXII., p. 544, the history of a case where the body was embalmed a few hours after death, and where Dr. Wm. B. Hills found arsenic in the stomach. The undertaker admitted, however, at the inquest, that he had poured some of the arsenical embalming fluid into the mouth, a fact he had previously denied. No analysis of the brain appears to have been made. The prosecution was abandoned. Dr. Durell is emphatic on the point of legislation restraining undertakers from using such measures to preserve the dead.

Since there is no form of murder more difficult to detect, more evasive of the just retribution of the law in the conviction of the criminal, every avenue of possible escape from discovery should be well guarded, and as no more ready means appears to exist to-day for the poisoner to complicate the chemical analysis, if not to render its results wholly valueless, to sow discord among experts and defeat in every way the meting out of justice, than to avail himself of the over zealous attentions of the funeral director, there should be concerted action on the part of all interested in this department of chemistry to form public opinion and secure the enactment of prohibitory laws.

The very speedy diffusion which seems to have taken place in

this particular instance leads me to lay the facts before you, for it shows how even the element of time which might have been a saving clause in favor of the chemist, is taken from him, and demands of us a most outspoken protest against a growing evil, which may frustrate the ends of justice in some cases, in others cause unjust suspicion to rest upon innocent parties.

PECULIAR PERFORATION OF ZINC RODS.

By Charles E. Munroe.

Through the courtesy of Asst. Eng. B. C. Bryan, U. S. N., of the U. S. Torpedo Boat "Cushing," I received a short time since some fragments of zinc rods which after exposure to the action of hot water in the wing-cylinders of the Cushing's boilers had become perforated throughout their entire length with a central canal.

These boilers are of the Thornycroft pattern and each consists substantially of a horizontal cylinder or "separator," placed in the upper part of the furnace, and two horizontal cylinders placed below in the wings of the furnace, each of these "wing-cylinders" being connected with the separator by a large number of steel "generating" tubes of small diameter which are bent in such shapes and so placed as to form a continuous arch over the grate, and yet spring from the tops of the wing-cylinders and enter the top of the separator. The wing-cylinders are also connected with the separator by means of pipes, known as the "down-comers," which are of larger diameters and have a more direct lead than the generating tubes.

The effect of this arrangement is, that when the boiler is filled with water to its normal level of about half-way up the separator and the fires are started, steam is rapidly generated in the generating tubes from which it rises with the water to the separator, where, by means of baffle plates, separation is effected, the steam passing to the engines and the water descending by the down-

comers to the wing-cylinders, from which it again rises to the generating tubes; the circulation being thus maintained and its velocity being governed by the area and condition of the fire and the extent of the feed.

As, owing to the disastrous effect of scale in these multitubular boilers, soft water only can be used in them, it is essential to condense the exhausted steam, but as the condenser is made of tinned brass tubes with a copper shell the electro-chemical action between the metals tends to pit and corrode the steel boiler; hence to prevent this, and also the pitting, which, as I have elsewhere shown,* may be caused by the action between masses of steel in different physical or chemical conditions, zinc, which is electro-positive to the steel, is put in the boiler in such a way as to be in close metallic contact with it. This practice has long been in vogue for the protection of boilers, but more recently it has come into use for the preservation of the vessels themselves, Mr. Thornycroft, in his "Instructions of March 15, 1889," for the care and preservation of the steel hulls of his torpedo boats, recommending that, in order to protect them from pitting, pieces of zinc be placed on the inside of the vessel at intervals of from 5 to 6 feet apart from stem to stern and as low down as possible, so that they may be immersed in any bilge water present, and so fastened as to be in close metallic contact with the frames of the vessel, the arrangement being made under the supervision of the Naval Chemist.

Usually zinc for boilers is employed in the form of plates which are suspended in the boiler, and this is the form in which it is used in the separator of the Cushing's boiler, but it is introduced into the wing cylinders, which are 14 inches internal diameter by 8 feet in length, in the form of cylindrical rods, $1\frac{7}{64}$ inches in diameter by 5 feet in length, which are squared off for about one inch in length at each end, so as to fit into notches in a steel frame from which they are suspended by their ends in the centre of the wing cylinder. These rods have evidently been cast vertically, and when an unused one is fractured the exposed

* *Proc. U. S. Naval Institute* **8**, *502*; 1882.

surface of the interior shows a mass of feather-like fretted crystals radiating in pyramidal groups from the centre, but forming a compact mass, except for an occasional, but non-continuous, small cavity at the centre. The exterior of the rod is of a dull blue color, and appears to have been "chilled" in casting.

The rods, from which the pieces exhibited before you were taken, had been exposed in the boiler for about two months, but the steam was on during this time for but 608 hours, the pressure varying from 50° to 250° pounds, which is equivalent to temperatures of from 137° to 205° C.* When taken from the boiler, these rods were found to have increased considerably in diameter; to have become oval in form; to be perforated throughout their entire length, with a hole at the centre of somewhat irregular shape, and varying in diameter from $\frac{1}{16}$ to $\frac{1}{4}$ inch; to be more or less corroded at intervals on the surface; to be bent down between the points of suspension; and to be so rotten as to easily break under their own weight.

The extent of the increase in diameter is shown from the following measurements of five sections from used rods, the diameter of the unused rod being $1\frac{27}{64}$ inches.

	DIAMETERS.	
	Greatest.	Least.
1st section	$1\frac{42}{64}$	$1\frac{39}{64}$ inches.
2d "	$1\frac{62}{64}$	$1\frac{38}{64}$ "
3d "	$1\frac{60}{64}$	$1\frac{39}{64}$ "
4th "	$1\frac{51}{64}$	$1\frac{37}{64}$ "
5th "	$1\frac{49}{64}$	$1\frac{44}{64}$ "

When split longitudinally these sections were found to be filled with radial fissures, and the bundles of feather shaped crystals were coated superficially with oxide.

From consideration of the circumstances I am of the opinion that the formation of the tubular canals in the rods is due to the fact that, as cast, the radiating crystalline mass is held in place by the outer envelope of metal which is produced by the contact of the exterior portion of the molten mass with the cooler walls

*J. Perry, *Treatise on Steam*, p. 42, 1874.

of the mould, and that when, through the erosion or corrosion of this envelope by the rapidly circulating heated water, the tension is removed, the crystals are free to move over one another; and that when cooled from the high temperature to which they have attained the bundles of crystals contract along the transverse axis of the rod, away from the centre, and since there is no longer a contracting, continuous exterior envelope to bring them back to their original positions the canals result. The oval form which the rods assume is due to the action of the force of gravitation at the time when the force of attraction of cohesion among the particles of the mass is least. And the action is aided by the fact that the higher limit of temperature which obtains in the boiler is approximately that at which cast zinc becomes quite easily disintegrated.

The appearance of these rods is shown in the cut where A represents a transverse section of an unused rod, and the remainder represent transverse and longitudinal sections of used rods.

I am informed by Lt. Cameron McR. Winslow, U. S. N., commanding the "Cushing," to whose courtesy I am much indebted, that 250 pounds of zinc are used for a single charge in one boiler, and that when the boilers are first run this charge is so completely destroyed in seven days' steaming, that sometimes only small fragments and sometimes no portion whatever of the zinc is found remaining in the boiler at the end of this time. I have had no opportunity of learning what becomes of this mass, as the "Cushing" was put out of commission when my attention was called to the matter.

ON THE COMPOSITION OF BARYTO-CELESTITES.

By Dr. C. W. Volney.

During an examination of minerals, containing barium and strontium, with the view of ascertaining their economical value, I found some interesting coincidences between the results of former observations and my own.

In the silurian limestones of Canada, especially in those of the eastern part of the Province of Ontario, occur considerable deposits of barites and celestites, and although I found some barites of remarkable purity, the greater part of the celestites which came under my observation contain admixtures of barium sulphates in such quantity and regularity that they can hardly be considered accidental.

The barites proper agree in composition and forms of crystallization with those already described. The following gives the analytical results of barites from the County of Renfrew:

H_2O	0,0040
$BaSO_4$	98,3000
$SrSO_4$	0,0435
$CaSO_4$	0,0104
Al_2O_3	0,0015
Fe_2O_3	0,0190
SiO_2 (insoluble)	0,0075
" (soluble)	0,0020
	98,3879

This mineral occurs in solid, white and opaque crystalline masses, with hardly a tinge of coloring in any part of it; orthorhombic, and of rather a tabular character.

The minerals, which were forwarded to me as celestites, were of a fibrous and radiated character, white, opaque, orthorhombic and brittle. Of two samples from deposits in the Counties of Renfrew

and Lanark, the following shows the analytical results; the differences in these two as well as in other cases, are so slight, that they may be safely ascribed to accidents in the analytical work and not to any differences in composition :

H_2O	0,200
$Ba\,SO_4$	39,850
$Sr\,SO_4$	58,200
Al_2O_3) Fe_2O_3)	0,100
$Ca\,O$	0,072
$Si\,O_2$ (insoluble)	0,350
" (soluble)	0,150
	98,928

For the purpose of comparing the composition of these minerals with celestites proper from the same localities, I procured a specimen from Frontenac County. This agrees perfectly with the descriptions of the mineral; it is transparent, orthorombic and tabular and considerably harder and less brittle than the above described specimens from Renfrew and Lanark, of the fibrous and radiated character.

An analysis afforded :

H_2O	0,1500
$Sr\,SO_4$	96,0000
$Ba\,SO_4$	3,7000
$Si\,O_2$ (insoluble)	0,0930
" (soluble)	0,0670
Al_2O_3	0,0430
Fe_2O_3	0,0570
$Mg\,O$	0,0025
	100,1125

The mineral gave none of the reactions of lime.

It may be considered as a representative of celestite proper.

Dana[1] notes the occurrence of minerals, which correspond in

[1]System of Mineralogy, 5th ed., 1873; p. 620.

their composition with those from Renfrew and Lanark ; Thompson terms these baryto-celestites and Hugard gives for the angle $i \wedge i = 103\frac{1}{2}°$, intermediate between barite and celestite. The mineral analyzed by Thompson came from Drummond Island, Lake Erie, and gave him 61,63 Sr SO_4 and 35,11 Ba SO_4. Dana says (l. c.) that this analysis needs confirmation. I have, so far, not succeeded in obtaining the mineral from Drummond Island, but the minerals from Renfrew and Lanark seem to confirm Thompson's results and, at all events, justify the terminology, and should be called baryto-celestites.

I will state, in conclusion, that all these minerals were analysed in the following manner : 2 grms. finely pulverized, were first heated in an air bath to a temperature between 150-180°, to ascertain the quantity of water, the remnant melted with potassium-sodium carbonate in the usual way and the mass treated with boiling water. The resulting solution of alkaline sulphates served for determination of the sulphuric acid of the mineral. The earthy carbonates dissolved in hydrochloric acid and precipitated with sulphuric acid, gave the alkaline earth as sulphates, and these were treated with an ammoniacal solution of ammonium carbonate, to separate barium from strontium and calcium. As a means of control, I have, in some cases, determined barium by precipitating it from the solution of the alkaline earths in hydrochloric acid by hydrofluosilicic acid ; it served to ascertain if the change of strontium and calcium sulphates into carbonates had been perfect.

New York, December 21, 1891.

AN ALCHEMICAL CHART.

By Prof. W. P. Mason.

This curious chart, indicating the method of manufacturing gold in twelve steps, is to be found among a number of alchemical writings collected by the French sculptor Chaudet, in 1788. No reference is made to the authorship of the chart, and no written description of the details of the process exists, except the terse and blind latin inscriptions upon its face.*

*This chart represents the supposed production of gold in a series of hermetically sealed flasks. The brilliant coloring of the chart renders it unsuitable for reproduction.—Ed.

Abstracts of American Patents Relating to Chemistry.

(*From the U. S. Patent Office Gazette.*)

(*Issued November 3, 1891.*)

462,229.—Compound of rosin. George E. Armstrong, New York, N. Y.

A compound of rosin, vegetable oil and a carbonate of an alkali.

462,245.—Reduction of aluminium sulphate to sulphide. Philip A. Emanuel, Aiken, S. C.

Aluminium sulphate is subjected to the action of carbon bisulphide in a closed and highly heated retort; or the sulphate is mixed with sulphur and then subjected to the action of carbon bisulphide in a closed and highly heated retort.

462,277.—Pulverizing or reducing mill. John A. Peer, Brooklyn, N. Y.

462,326.—Apparatus for treating gold and silver ores. Almarin B. Paul, San Francisco, Cal.

462,366.—Process for making caustic soda. James Simpson, Liverpool, England.

The process consists in treating calcium phosphate with hydrochloric acid, adding to this solution sodium sulphate, drawing off the liquor and concentrating the same, subjecting the concentrated mass to a red heat and fusing the same, dissolving the fused mass, separating the sodium phosphate and sodium chloride contained in the solution, treating the sodium phosphate with caustic lime, and separating the calcium phosphate and caustic soda resulting.

462,414.—Brown dye. Christian Rudolph, Offenbach, Germany.

A brown basic dyestuff derived from chloride of paradiazoacetanilid, metaphenylene-diamine and concentrated muriatic acid. It consists of a black powder easily soluble in water. The aqueous solution is rapidly discolored by zinc dust and muriatic acid and gives a brown precipitate on the addition of caustic soda.

462,415.—Blue black azo dye. Christian Rudolph, Offenbach, Germany.

A blue black tetrazo dyestuff derived from tetrazo diphenyl or ditolyl amido-oxy-alphanaphthaline disulpho acid and alpha or beta naphthylamine. Soluble in water with red violet color, and in concentrated sulphuric acid with a blue color.

462,449.—Secondary battery. John H. Palmer, Boston, Mass.

462,535.—Amalgamating and extracting gold from refractory or other ores. William Crookes, London, England.

The improvement consists in submitting the ore to the combined action of a solution of a mercurial salt and an alternating electric current.

462,537.—Water purifier. Easton Devonshire, London, England.

462,544.—Bromine compound. Frank H. Fischedick and Charles E. Koechling, New York, N. Y.

462,551.—Ice making and refrigerating apparatus. Frederick B. Hill, London, England.

462,561.—Gas generator. Arthur Kitson, Philadelphia, Pa.

462,567.—Process of making alkaline carbonate and chlorine. Farnham M. Lyte, London, England.

A process for continuously producing "sodic or potassic carbonate and chlorine, which consists in decomposing sodic or potassic nitrate by heating it with calcic carbonate, lixiviating out the sodic carbonate and converting the nitrous fumes evolved into aqueous nitric acid by the action of air or oxygen and water, dissolving plumbic oxide in the nitric acid, precipitating plumbic chloride by means of sodic or potassic chloride, fusing the plumbic chloride and decomposing it electrolytically to form chlorine and metallic lead for use over again."

462,602.—Process of purifying iron and steel. Theodore R. Timby, Washington, D. C.

The process for converting or decarburizing and purifying iron consists in introducing mingled jets of animal oil and decomposed or superheated steam into the molten metal.

(Issued November 10, 1891.)

462,678.—Composition of matter for wall coverings. George W. Abell, Indianapolis, Ind.

Consists of white lead, litharge, sugar, linseed (oil cake) meal, lime, calcined gypsum, sand and water in certain proportions.

462,693.—Secondary battery. Nathan H. Edgerton, Philadelphia, Pa.

462,694.—Process of purifying tannin solutions by electrolysis. August Foelsing, Dusseldorf, Germany.

462,730.—Method of preparing salt for table use. Charles E. Ougley, New York, N. Y.

Damp salt in a powdered or granulated condition is mixed with starch and then exposed to the action of heat for the purpose of softening the starchy granules, and then drying the softened granules upon the salt particles.

462,824.—Blue azo dye. Gastav Schultz, Berlin, Germany.

A blue direct dyeing dyestuff obtained by combining one molecule of tetrazo salt substantially such as described with one molecule of alpha-

naphthylamine, again diazotizing the compound and combining with the resultant product two molecules of an alphanaphthol disulpho acid.

462,904.—Refrigerating apparatus. Chas. F. Miller, Lancaster, Pa.

463,058.—Centrifugal liquid separator. John Laidlaw, Glasgow, Scotland.

463,062.—Apparatus for purifying oil. James J. Lowden, Everett, Boston, Mass.

463,112.—Process of recovering tin from tin scrap. Hans C. W. Harmsen, Hamburg, Germany.

463,120.—Leaching vat for separating metals from their ores. Donald Dennes, Denver, Col.

(*Issued November 17, 1891.*)

463,139.—Process for manufacturing gas. Joseph H. Collins, Philadelphia, Pa.

463,143.—Process of and apparatus for preparing aluminium sulphide. Philip A. Emanuel, Aiken, S. C.

A special form of apparatus for reducing aluminium sulphate to sulphide by mixing the sulphate with sulphur, heating the mixture and then treating the residual product with carbon bisulphide.

463,162.—Crushing machine. Robert McCulley, Philadelphia, Pa.

463,305.—Ore separator. William D. Hoffman, Brewster, N. Y.

463,326.—Albuminized paper. Arthur Bott, Albany, N. Y.

An improved albuminized paper which consists in first giving the paper a waterproof facing of barium sulphate and then coating it with albumen.

463,338.—Continuous evaporating apparatus. Otto Schulz, Buig, Ger-

463,367.—Fumigator. William Martin, Glenwood, Cal.

463,409.—Apparatus for directing the proper administration of medicine. Edward P. Roberts, Cleveland, Ohio.

463,421.—Process of manufacturing sparkling wines. Wilhelm Gerbel, Rohrsbach, Switzerland.

The method consists "in introducing into a closed vessel a ferment and a portion of the wine mixed with the sugar necessary for the fermentation, then separately introducing over this vinous solution of sugar the remaining body of wine and keeping the two from mixing so far as possible, while allowing the carbonic acid evolved from the vinous solution of sugar to rise into and be diffused throughout the body of the wine, and finally drawing off the sparkling wine."

463,427.—Metallic alloy. Thomas MacKellar, Philadelphia, Pa.

An alloy of lead, tin, copper, aluminium and antimony.

463,429.—Apparatus for obtaining, separating and disinfecting a fertilizer. Metrophane Nadicin, St. Petersburg, Russia.

463,466.—Evaporating apparatus. Edward Theisen, Sinsig, Germany.

463,482.—Ore concentrator. Edw. W. Clark, Butte City, Mont.

463,486.—Process of welding metal electrically. Charles L. Coffin, Detroit, Mich.

463,487.—Electric welding or working of metals. Charles L. Coffin, Detroit, Mich.

463,503.—Device for charging and discharging enameling ovens. Aug. H. Franck, Sheboygan, Wis.

463,509.—Ore sampling device. Robert C. Hawley, Pueblo, Colo.

463,514.—Separator. John F. Keiper, Denver, Colo.

463,538 and **463,539.**—Crushing and pulverizing machines. Rob. McCulley, Philadelphia, Pa.

463,561.—Apparatus for the manufacture of sugar sirups. Joseph I. Wilson, Coldwater, Mass.

(*Issued November 24, 1891.*)

463,629. Hydrocarbon burner. William R. Jeavons, Cleveland, Ohio.

463,642.
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Methods and apparatus for the manufacture of plate glass, cylinders, bottles, etc. Roger S. Pease, Rose, Minn.

463,656.—Churn. Joseph P. Wilson, Glasgow, Ky.

463,712.—Assay furnace. Pierre de P. Ricketts and Edward R. Bush, New York, N. Y.

463,731.—Process of separating cream from milk. John J. Berrigan, Avon, N. Y.

The process of separating the cream from milk consists in "subjecting the milk while tightly confined to an air pressure of one or more atmospheres above the normal for a limited period of time and subsequently reducing the pressure on the milk to the normal before the cream has all risen."

463,757.—Filter. Omar H. Jewell, Chicago, Ill.

463,767.—Process of making chlorine. Prosper DeWilde and Albert Reychler, Brussels, Belgium.

A process for "producing chlorine by first treating with hydrochloric acid gas a mixture of sulphate of magnesium and manganite of magnesia, and, secondly, treating with heated air the thus obtained mixture of sulphate of magnesium, chloride of magnesium, and chloride of manganese."

463,769.—Explosive and process of making the same. James M. Pollard, Washington, D. C.

An explosive powder composed of finely divided chlorate, nitrate, and sulphur, the particles of each constituent being coated with paraffine.

463,794.—Centrifugal separator. Carl G. P. de Loval, Stockholm, Sweden.

463,799.—Apparatus for the manufacture of gas. George M. S. Wilson, Toronto, Canada.

463,800.—Churn. John H. Brownfield, Moberly, Mo.

463,823.—Pulp beater and refining machine. Sharon D. Beach, Seymour, Conn.

463,841.—Manufacture of chromates and bichromates. Jules Massignon and Etienne Watel, Paris, France.

Chrome mineral is pulverized, mixed with calcium carbonate and calcium chloride; the mixture then heated to cause the carbonate to be converted into caustic lime and subsequently oxidized. The calcium chloride is then washed out and subsequently the calcium chromate finally precipitated by a lead salt to form lead chromate.

463,846.—Apparatus for washing, dyeing and treating textile materials. Ely Sutcliffe and George E. Sutcliffe, Winfield, Eng.

463,853. } —Apparatus for burning hydrocarbons. James H. Bullard,
463,854. } Springfield, Mass.

463,870.—Calcium light apparatus. George R. Prowse, Montreal, Canada.

463,875.—Process of removing free hydrochloric acid from sulpho-chlorides. Adolph Sommer, Berkeley, Cal.

Air, deprived of its moisture, is passed through the sulpho-chlorides.

463,898.—Blue dye, Albert Hermann, Höchst-on-the-Main, Ger. The sulphonic acids of metaoxy, meta-amido, or alkylized meta-amidotetralkyl-diamido-triphenyl carbinols are oxidized with salts of oxide of iron or chromic acid. A copper red powder with metallic lustre, sol. in water, showing intense indigo-blue coloration, insol. in alcohol and benzine, dyeing wool and silk in acid bath in blue shades.

463,965.—Process and apparatus for generating gas. William H. Harris, Boston, Mass.

(*Issued December 1, 1891.*)

464,008.—Furnace. Thomas E. Caddy, Nottingham, Eng.

464,020.—Apparatus for distributing liquids. August Hamelberg, Santo Domingo, S. Domingo.

Apparatus for beer. John Hartin, Boston, Mass.

464,040.—Apparatus for generating gas. Adolph Richter, New York, N. Y.

464,056.—Process of educing and degumming fibrous material. George E. Armstrong, New York, N. Y.

The disintegrated fibers are treated with a highly resinous saponaceous solution.

464,083.—Ore crusher. George Raymond and Albert Raymond, Chicago, Ill.

464,092.—Process of destroying Canada thistles. William Burton, Plymouth, Wis.

The thistles are treated with a mixture consisting of naphtha and naphthaline.

464,096.—Apparatus for obtaining metal of the alkalies from molten chloride. Ludwig Graban, Hanover, Ger.

464,097.—Process of obtaining metallic sodium. Ludwig Graban, Hanover, Ger.

The process of obtaining sodium from its chloride by "combining sodium chloride with another chloride of the metals of the alkalies and with a chloride or chlorides of the metals of the alkaline earths, in the proportion of one molecule of the latter to three molecules of the chlorides of the metals of the alkalies, melting the trisalt and separating the sodium by electrolysis."

464,103.—Furnace for wasting ores. Francis O'Brien, Elizabeth, N. J.

464,104.—Apparatus for making solutions of bisulphites. Frank J. Peck and James A. Ontterson, Dexter, N. Y.

464,116.—Plastering compound. William M. Dawson, St. Louis, Mo.

A composition of matter, consisting of glue, linseed meal and chalk on air slacked lime.

464,120—Manufacture of artificial stone. Ludwig Grote, Dresden, Ger.

The process consists in "steeping cellulose in oxide of copper ammonia, freeing the mixture obtained from superfluous liquid, mixing a filling material consisting of magnesium chloride, zinc chloride and magnesite, with the mass and moulding the latter into suitable shapes."

464,135.—Blue dye. Meinhard Hoffmann, Frankfort-on-the-Main, Germany.

Blue coloring matters produced by mixing solutions of amidonaphthol-disulpho acid and the tetrazo derivatives of paradiamines and sufficient alkali to keep the solution alkaline. A dark bronze-like powder, easily sol. in water, with a blue color which is not changed by addition of carbonate of soda; insol. in alcohol and ether, sol. in strong sulphuric acid with pure blue shade. The latter solution diluted with water, precipitates the dyestuff in the form of a reddish blue amorphous precipitate.

464,147.—Alloy. Alex. W. Cadman, Edgewoodville, Pa.

An anti-friction alloy, composed of antimony, tin, copper and alluminium.

464,166.—Evaporating apparatus. William Venuleth, Darmstadt, Ger.

464,171.—Furnace for the incineration and destruction of house garbage, etc. Edw. W. Cracknell, Sydney, South Wales.

464,197.—Dry air closet. Oscar A. Lanphear, Cincinnati, Ohio.

464,199.—Digester for treating paper stock. John MacCormack and Harry L. Van Zile, Albany, N. Y.

464,236.—Churn. George P. Withorn, Emporia, Kans.

464,336.—Paint. Wells H. Shearer, Arkansas City, Kans.

A waterproof paint consisting of coal tar, pitch, common mineral paint, hydraulic cement, gray ochre, asbestos, air slacked lime, salt, liquid drier and litharge.

464,351.—Process of and apparatus for manufacturing copper tubes. Alexander S. Elmore, Leeds, Eng.

464,367.—Insulating composition. Smith W. Kimble, Denver, Col.

The composition consists of pulverized mica, silicate of soda, and a mineral substance such as talc free from lime, combined and moulded under pressure.

464,369.—Composition of matter for insulating purposes. Smith W. Kimble, Denver, Col.

Composition composed of pulverized mica, silicate of soda, sulphur or sulphur compounds, and another mineral substance such as finely divided asbestos, and molded under high pressure without heat.

464,389.—Vacuum evaporating apparatus. Sigismund Pick, Szczakowa, Austria, Hungary.

464,395.—Method of making alloys. Samuel Singley, New York, N. Y.

"The mode of manufacturing anti-friction alloys, which consists in adding sal-ammoniac to molten lead, agitating the mass and removing the scum, adding a proportionate quantity of antimony, and covering the mass with powdered graphite and then agitating the mass."

464,419.—Fumigator. Stephen P. Bozarth, Wimberly, Tex.

464,423.—Process of tanning and dressing leather. Daniel W. Brown, Isaac Clark and James F. Brown, South Fork, Mo.

464,463.—Crushing and pulverizing machine. Robert McCully, Philadelphia, Pa.

464,474.—Feed water purifier. Michael Egan and Calvin G. Udell, North Indianapolis, Ind.

(*Issued December 8, 1891.*)

464,509.—Chemical eraser. Clarence R. Macomber and Ernest V. Scribner, Worcester, Mass.

464,515.—Process of manufacturing hydraulic cement. José F. Navarro, New York, N. Y.

"Process of manufacturing Portland cement, which consists in first burning the raw unground rock in a vertical stationary kiln, next pulverizing the burned product, then adding any required additional element, then vitrifying or calcining the pulverized material in a rotating horizontal kiln, and finally pulverizing the product."

464,516.—Process of manufacturing Portland cement. José F. Navarro, New York, N. Y.

To pulverized dry argillaceous rock containing the chemical constituents of Portland cement are added, when deficient in lime, a definite proportion of cement rock high in lime or limestone pure, also ground raw. After thoroughly mixing the dry powders they are burned in a rotating kiln, and finally grinding the resulting clinkers to a powder.

464,538.—Violet dye. Arthur Winberg, Frankfort-on-the-Main, Germany.

Solutions of the substituted diamidodiphenylmethanes are mixed with solutions of aromatic monomines, and then oxidizing substances are added to the mixture. A violet coloring matter, tetralkyldisulphobenzyldiamidotriphenylcarbinol, forming a bronze-like powder easily solvent in water with violet color, which is not changed by dilute alkali, less sol. in alcohol, insol. in ether. Strong sulphuric acid dissolves it with a yellow orange shade. The latter solution when diluted retains the dyestuff dissolved with a green shade.

464,543.—Pocket apparatus for determining the amount of carbonic acid in mixtures of gases. Heinrich Wolpert, Nuremberg, Ger.

"A pocket apparatus for testing carbonic acid in mixtures of gases, consisting of a cylinder provided with a scale indicating the amount of the air at different elevations, and a scale having marks indicating the quality of the gas or air, a piston in said cylinder, and a tube connected with said piston."

464,566.—Violet dye. Meinhard Hoffman, Meinken, Ger.

A new coloring matter $C_{10}H_4(SO_3Na)_2=[N=N—C_{10}H_6NH_2(a)]_2$ produced by the action of tetrazonaphthaline beta-disulphonic acid upon alpha-naphthylamine. Easily sol. in hot water with violet color in conc. sulphuric acid with a blackish-blue color, and by reducing agents it is decomposed into diamidonaphthaline beta-disulphonic acid and naphthylinediamine.

464,642.—Disintegrating furnace. Frank Walker, Los Angeles, Cal.

464,669.—Apparatus for purifying water. William Anderson, Erith, County of Kent, Eng.

464,672.—Apparatus for separating gold and silver from ore. William D. Bohn, London, Eng.

464,695.—Apparatus for heating with fluid fuel. William A. Koneman, Chicago, Ill.

(*Issued December 8, 1891.*)

464,700.—Apparatus for manufacturing fuel gas. William A. Koneman, Chicago, Ill.

464,717.—Hydrocarbon burner. Henry Ruppel, Cleveland, Ohio.

464,719.—Incandescent lamp filament. Ludwig K. Böhm, New York, N. Y.

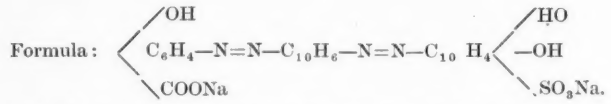
Carbonizable material is impregnated with carbonates of calcium or magnesium, and then carbonized, producing a filament of carbon and oxide of calcium or magnesium.

464,747.—Retort for making bisulphide of carbon. Joseph Beck, Newark, N. J.

464,775.—Blue green azo dye. Richard Lanch and Karl Krekeler, Elberfeld, Germany.

A bluish black powder, difficultly sol. in cold water, more easily sol. in hot water with blue violet color, readily sol. in alkaline solution with almost pure blue color, sol. in conc. sulphuric acid with dark green color, which is altered by addition of water to a pure blue, the dyestuff gradually separating in dark blue flakes. Wool, mordanted with chromium salts, is dyed in bluish green shades very fast against sunlight, soap and milling.

The dyestuff is produced by combining one molecular proportion of the diazo compound of amidonaphthaline azo-salicylic acid with one molecular proportion of dihydroxynaphthaline monosulphonic acid in the presence of sodium acetate.

Formula: 

464,779.—Apparatus and method of making fuel gas. Edw. P. Reichhelm, Jersey City, N. J.

464,782.—Machine for cleaning vegetable fibre. Manuel Villamor, Meriden, Mex.

464,800.—Hemp cleaning machine. William H. Muggeridge, Bellevue, Ky.

464,815.—Compound for preparing iron ore for furnace use. Gurdon Conkling, Glen Falls, N. Y.

Compound consists of comminuted iron ore, magnesium chloride, magnesium oxide, calcium oxide, sodium silicate and water.

464,816.—Ore separator. Wm. G. Conkling, Glen Falls, N. Y.

464,850.—Hydrocarbon burner. Joseph Burns, Fort Plain, N. Y.

464,861.—Process of making phenylethylmethylpyrazolone. Gustav Ebert, Höckst-on-the-Main, Germany.

"The process of making phenylethylmethylpyrazolone by heating phenylmethylpyrazolone with iodethyl, then driving off the excess of iodethyl, taking up the free iodine by sulphurous acid, and decomposing the product of the reaction by soda lye; now taking up the oil by benzine, treating with hydrochloric acid, dissolving the hydrochlorate in alcohol, and pouring it into ether, filtering and drying the product, dissolving it again in water, adding soda lye, taking up the oil in benzine, distilling off the latter, and drying the oil remaining back in an exsiccator or by an air pump. Phenylethylmethylpyrazolone is very sol. in water, al-

cohol, benzine, ether and chloroform, insol. or scarcely sol. in ligroine, deliquescent on being left exposed to the air, melting at 71° and 72½° C., having a formula, by analysis, of $C_{12}H_{14}N_2O$, forming with sodium nitrite and acetic acid a green, scarcely soluble nitroso compound, and with ferric chloride a red double salt, containing three molecules of the base and two molecules of $Fe\,Cl_3$."

464,917.—Manufacture of Venetian red. Walter J. Wigg, Frodsham. Kington-upon-Hull, England.

"The process of producing Venetian red, which consists in treating a proper solution of iron and of a body-producing substance with milk of lime or equivalent reagent, agitating and oxidizing the mixture by blowing air or other oxidizing gas or agent through it, further oxidizing and cleansing the precipitate by steam and water, and then furnacing the precipitate."

464,920.—Process of manufacturing cast steel. Lewis Cameron, Pittsburg, Pa.

464,922.—Dental vulcanizer. Thomas J. Carrick, Baltimore, Md.

464,933.—Process of obtaining metals from their ores or compounds by electrolysis. Charles S. Bradley, Yonkers, N. Y.

464,934.—Furnace for the manufacture of gas. Jesse A. Dubbs, Alleghany, Pa.

(*Issued December 15, 1891.*)

464,963.—Apparatus for producing gas. Abraham A. Fritz, Brussels, Belgium.

465,006.—Cupola furnace. John Walker, Cleveland, Ohio.

465,031.—Process of extracting oil. Ernest G. Scott, Port Sunlight, England.

Uses carbon tetrachloride as a solvent for the oils.

465,077.—Apparatus for manufacturing heating and illuminating gas. James S. Rogers, Rockport, Mass.

465,085.—Apparatus for manufacturing gas. James S. Rogers and James H. Baker, Saratoga Springs, N. Y.

465,116.—Brown azo dye. Christian Rudolph, Offenbach-on-the-Main, Germany.

Diazotized toluylenediamine sulpho-acid 1 : 2 : 4 : 6 ($CH_3 : NH_2 : SO_3H : NH_2$) is first combined with two molecules of metaphenylenediamine and the intermediate product further treated with diazotized alpha or beta naphthylamine sulpho-acid. The dyestuff is a blackish powder with a greenish hue, sol. in conc. sulphuric acid with a brown, violet, red color and in water with a brown color.

465,146.—Apparatus for the manufacture of gas. Augustin Seguin, Lyons, France.

465,178.—Photographic process for printing in colors. Johann C. Hösch, Vienna, Austria-Hungary.

465,249.—Fuel produced from lignite. Albert Edelmann, Austin, Texas.

465,250.—Process of extracting copper pyrites. Thomas A. Edison, Llewellyn Park, N. J.

The method consists "in first concentrating the whole by running or otherwise separating the naturally magnetic material magnetically, then heating the remainder to a temperature sufficient to render the chalco-pyrite magnetic and insufficient to render the iron pyrites magnetic, separating the magnetic chalco-pyrite magnetically. Then reheating the remainder to a much higher temperature to render the iron pyrites magnetic and separating the same magnetically, leaving the gold, silver, lead, etc., as a final non magnetic residue."

465,280.—Method of making nitro-cellulose. Hudson Maxim, New York, N. Y.

The process "consists in immersing the material to be nitrated successively in two baths each containing a large excess of mixed nitric and sulphuric acid, in the first and stronger bath of which the cellulose is placed until partially converted into a lower nitro compound, and in the second and weaker of which baths the completion of the conversion into a higher nitro compound takes place, and the acids mixture in the second or last bath being maintained at a suitable working strength by the stronger acids of the first bath adhering to the cellulose material."

465,314.—Process of manufacturing steel. William J. Bell, Philadelphia, Pa.

465,321.—Apparatus for determining the amount of water in steam. Max Gehre, Roth, Germany.

465,330.—Process of manufacturing cement. Calvin Tompkins, New York, N. Y.

Highly heated slag as it comes from the furnace and before it has been allowed to cool, is treated to a bath of hydrat of lime, dried and then pulverized.

465,349.—Magnetic ore separator. Clinton M. Ball, Troy, N. Y.

465,369.—Production of insulating coatings or linings in electrolytic apparatus. Ludwig Graban, Hanover, Germany.

465,393.—Sterilizing apparatus. Marcell von Skotnicki, Charlottenburg, Germany.

465,398.—Hydrocarbon vaporiser and burner. Richard Thompson, London, Canada.

(*Issued December 22, 1891.*)

465,461.—Machine for enameling sheet metal.
465,462.—Machine for brushing enamel, etc.
Hubert Claus, Thale-on-the-Harz, Germany.

465,474.—Treatment of spent soap lye. Otto C. Hegemann, London, England, and Ebenezer K. Mitting, Chicago, Ill.

465,525.—Electrolytic apparatus for treating metals. Edward S. Hayden, Waterbury, Conn.

465,572.—Method and apparatus for producing railway ballast from furnace slag. John W. Diebold, Pittsburg, Pa.

460,582.—Separating machine. John G. Mundy, Jackson, Mich.

465,600.—Process of recovering cyanides from coal gas. William L. Rowland, Philadelphia, Pa.

"The process consists in adding a portion of iron salt to the liquor, boiling off the ammonia in the usual manner, and treating the settings with lime to obtain a solution of ferrocyanide of calcium; second, adding an alkaline chloride or sulphate to this solution to form the double salt, the ferrocyanide of calcium and the alkali, and finally decomposing this with an alkaline carbonate to form an alkaline ferrocyanide."

465,607.—Manufacture of hydrofluosilisic acid. Marc W. Beylikgy, New York, N. Y.

Ferrous sulphate is first mixed with the equivalent proportion of fine fluor spar, "next heating the said mixture to incipient redness in a close vessel, and causing steam to pass over it to decompose it and produce fluorhydric acid charged with vapor of water and finally passing the said acid condensed with water through silica."

465,614.—Compound to restrain the setting of plaster and process of making the same, a composition of quicklime, glue and flour.

465,646.—Furnace. John Haggerty, New York, N. Y.

465,654.—Combined chlorinating and filtering vessel. Donald Dennes, Deadwood, S. D.

465,667.—Crushing and grinding mill. George C. Janney, Springfield, Ohio.

465,668.—Vaporizer for hydrocarbon or similar fluids. Wm. J. Kenderdine, Philadelphia, Pa.

465,672.—Process of making steel. Gustav Lindenthal, Pittsburg, Pa.

465,703.—Process of refining petroleum and analagous oils. Chas. C. Mengel, Sr., Bay City, Mich.

The vaporized oils are treated under pressure with carbonic acid gaa.

465,717. } Compositions for covering steam pipes, etc. Robt. S Miller,
465,718. } Wilmington, Del.

465,735.—Dental vulcanizing apparatus. George B. Snow, Buffalo, N. Y.

465,746.—Hydrocarbon burner. Wm. H. Ames, Easton, Mass.

465,784.—Process of polishing sheets of pyroxyline material. Wm. Schmidt, Arlington, N. J.

465,796.—Carbonic acid generator. Jacob F. Wittemann, New York, N. Y.

465,817.—Petroleum burner. Louis Godder, Winchester, Mass.

465,822.—Process of and apparatus for purifying oil. James J. Lowden, Everett, Mass.

(*Issued December 29, 1891.*)

465,828.—Compound for carburizing metals. Samuel H. Brown, Boston, Mass.

The compound is composed of "bone-carbon, tungstic acid, calcined lime, soda-ash, and sal-ammoniac."

465,833.—Method of ornamenting iron tablets. Joseph Cavalli, London, Eng.

465,860.—Ink. Thomas W. Just, Robert Weiler, and Otto Heidepriem, Melbourne, Victoria.

Consists of carbon black, caustic soda, oxalic acid, india ink, vanadium, aleppo galls, nutgalls, gum arabic, aniline dye, with sufficient water to make a freely flowing ink.

465,871.—Apparatus for dyeing wool. Samuel Mason, Jr., Manchester, England.

465,872.—Process of treating metalliferous ores. Francis H. Molesworth, Adelaide, South Australia.

465,923.—Baker's oven. Fritz Dührkop, New York, N. Y.

465,944.—Hydrocarbon burner. Edwin G. Murmuery, Detroit Mich.

465,975.—Method of vulcanizing and drying wood. Charles Howard, New York, N. Y.

465,976.—Soda water apparatus. John Ormesrod, Brooklyn, N. Y.

465,979.—Ore concentrating machine. George E. Woodbury, San Francisco, Cal.

466,045.—Apparatus for deoxidizing, melting, and puddling iron ores. Henry A. Jones, Brooklyn, N. Y.

466,047.—Apparatus for cooling beer. Raymond S. Roswald, New York, N. Y.

466,138.—Secondary battery plate. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa.

A compound of sulphide and oxide of lead.

466,151.—Process of manufacturing beer and ale. Andrew W. Billings, Brooklyn, N. Y.

"The improvement consists in making a mash by mixing together raw grain and water and a portion of malt, gradually raising the temperature of this mash to the neighborhood of 146° Fahr., then rapidly heating it to between 180° and 212° Fahr., maintaining it at this temperature for a sufficient length of time to disintegrate the outer cuticle and dissolve the starch cells without the formation of empyreumatic products, then cooling it rapidly to below 165° Fhr., then adding the remaining portion of

malt required for the brew, maintaining it meanwhile at a temperature of over 155°, the wort being subsequently filtered out and subjected to further operation as in ordinary brewing."

466,152.—Percolator. Henry S. Blackmore, Mount Vernon, N. Y.

466,162.—Grinding and amalgamating mill for gold or silver ores. George Fraser, Auckland, New Zealand.

466,175. } Hydraulic presses. Lewis Miller, Philadelphia, Pa.
466,176. }

466,177.—Galvanic battery. Samuel Miller, Buxton, Eng.

466,202.—Black azo dye. Moritz Ulrich, Elberfeld, Germany.

The dyestuff is slightly sol. in cold water, readily sol. in hot water with deep violet color, also in hot solution of sod. carb. with the same color; by hot soda-lye and by ammonia sol. with intensely blue color; in conc. sulphuric acid with deep green color; which solution on addition of cold water gradually changes to greenish blue, blue, blue violet, and at last separates violet flakes leaving the supunatant liquid colorless. The formula for the dyestuff is

$$C_6H_4\begin{cases}SO_3Na \\ N{=}N{-}C_{10}H_6{-}N{=}N{-}C_{10}H_4\begin{cases}SO_3Na{-}OH \\ OH\end{cases}\end{cases}$$

466,210.—Apparatus for the manufacture of salt. Reginald C. Wilson, Liverpool, Eng.

466,223.—Dyeing apparatus. César Corron, Paris, France.

466,265.—Process of and apparatus for making charcoal. Leopold Zwillinger, Vienna, Austria-Hungary.

J. F. G.

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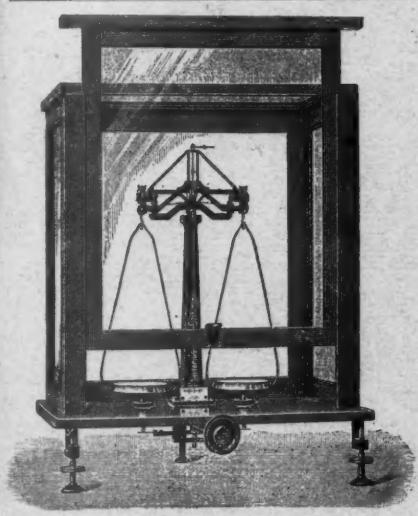

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